

Nautilus Environmental

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URS CORPORATION
SEATTLE

February 14, 2006

Jennifer Garner
URS Corporation
1501 4th Avenue, Suite 1400
Seattle, WA 98101-1616

Subject: Dangerous Waste Characterization: Maralco Restoration Project

Dear Jennifer,

Enclosed is a report for the dangerous waste characterization conducted by our laboratory on the eight samples identified as **Maralco Restoration Project (B-2-S, B-4-M, B-6-S, B-7-M, B-11-S, B-12-S, B-12-D, B-17-D)**. The tests were performed to determine if the samples would designate as a dangerous waste (100 ppm) under WAC 173-303. Test procedures followed Washington Department of Ecology guidelines.

One mortality was observed in one sample. Based on these results, none of the eight samples would designate as a dangerous waste.

If you should have any questions or concerns, please do not hesitate to contact me at 253-922-4296.

Sincerely,

Stacie Singleton

Stacie Singleton
Environmental Scientist
Washington Laboratory

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Nautilus Environmental, LLC

Dangerous Waste Characterization

Sample ID: Maralco Restoration Project: B-2-S, B-4-M,
B-6-S, B-7-M, B-11-S, B-12-S, B-12-D, B-17-D

Report date: February 13, 2006

Submitted to:

URS Corporation
1501 4th Avenue, Suite 1400
Seattle, WA 98101-1616

Washington
Laboratory
5009 Pacific Hwy East
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1.0 INTRODUCTION

Bioassay tests were conducted on eight waste samples collected from the Maralco Restoration Project. Tests were conducted to determine if the samples would designate as dangerous waste under WAC 173-303 using the test organism rainbow trout (*Oncorhynchus mykiss*). The eight samples were submitted by URS Corporation to Nautilus Environmental (Nautilus) in Tacoma, Washington. The samples, identified as B-2-S, B-4-M, B-6-S, B-7-M, B-11-S, B-12-S, B-12-D, and B-17-D, were received in the laboratory on February 2, 2006.

2.0 MATERIALS AND METHODS

2.1 Sample Collection and Receipt

URS Corporation personnel placed samples in labelled 8-ounce glass jars, packed them in a cooler, and transported them via courier to Nautilus Washington Laboratory in Tacoma, Washington. Immediately upon receipt at the laboratory, samples were verified with information on the chain-of-custody form and placed in a 4° C cold room until sample extraction.

2.2 Organism Procurement and Handling

Rainbow trout (*Oncorhynchus mykiss*) were obtained from TroutLodge in Sumner, Washington. The fish were transported to the laboratory, via Nautilus personnel, in oxygen-saturated water contained in sealed plastic bags. Upon arrival at Nautilus, organism receipt information was recorded, including water temperature and condition of the animals. Fish were held in 50-gallon glass tanks filled with laboratory water and fed trout food daily. Culture water was renewed on a daily basis. The fish were acclimated to the test environment for a minimum of seven days prior to test initiation.

2.3 Sample Extraction

Samples were extracted using a rotary extractor prior to test initiation. Eight hundred milligrams (mg) of sample were weighed and added to extraction jars. The jars were then filled with 200 milliliters (ml) of laboratory water and rotated at 30 rpm for 18 hours at 23° C. Extracted test material was either added to test chambers immediately or held at 4° C for no more than 24 hours prior to test initiation.

3.0 BIOASSAY PROTOCOL

Dangerous waste characterizations were conducted in accordance with Washington State Department of Ecology's (Ecology) protocol described in Biological Testing Methods 80-12 for the Designation of Dangerous Waste, Part A: Static Acute Fish Toxicity Test (1997).

3.1 Test Procedure

Rainbow trout (*Onchorhynchus mykiss*) were used as the test organism in the dangerous waste characterization test. Fish were exposed to 100 mg/L concentration of sample for 96 hours to determine the effect on survival. Test chambers consisted of 10-liter glass tanks filled with 8-liters of laboratory water. Tests were conducted in an environmental chamber maintained at $12 \pm 1^\circ \text{C}$ under a 16-hour light : 8-hour dark diurnal cycle. The experimental design consisted of three replicates per sample arranged in a predetermined random order on shelving in the environmental chamber. Table 1 gives a brief summary of test conditions.

Immediately prior to test initiation, extracted test material was added to the randomized test chambers already filled with laboratory water acclimated to test conditions. Extraction jars and cap liners were also added to the test chambers. Physical parameters consisting of temperature, dissolved oxygen (DO), pH, and conductivity were checked. The test was then initiated by adding ten randomly selected fish to each test container.

Table 1. Summary of Dangerous Waste Characterization Test Conditions

Test Number	0602-14WA
Test initiation date; time	February 7, 2006; 1300h
Test termination date; time	February 11, 2006; 1400h
Endpoint	Mortality or 96-hours
Test chamber	10-L glass tank
Test temperature	12°C
Dilution water	Carbon filtered municipal drinking water
Test concentrations (mg/L)	100, 0
Test solution volume	8 L
Number of organisms/ chamber	10
Number of replicates/concentration	3
Test organism	<i>Oncorhynchus mykiss</i> (rainbow trout)
Test organism source	Troutlodge; Sumner, WA
Test organism age	30 days from swim-up (Hatch date 12/25/05)
Feeding	No feeding during test
Mean weight	0.15 g
Mean length	24 mm
Ratio of longest to shortest	1.24
Loading	0.19 g/L
Photoperiod	16 hours light/ 8 hours dark
Extraction	Rotary agitation (30 +/- 2 rpm) for 18 hours
Deviations	None
Reference Toxicant	Copper sulfate

Prior to test initiation a representative subsample of ten fish from the cultures were weighed and measured. Fish were blotted dry and weighed on an analytical balance. Fish length was measured from snout to end of caudal peduncle. Mean weight and length of the fish for each test are shown in Table 1. Each test chamber was monitored daily for temperature, DO, pH, and the number of surviving fish. Data was recorded on laboratory bench sheets (Appendix A).

4.0 RESULTS

A summary of results for the dangerous waste characterization conducted on the samples is contained in Table 2. There was no significant mortality in any of the eight tests. One fish in

the B-4-M test went missing and was presumed dead. Based on these results, none of the samples would designate as a dangerous waste.

Table 2. Summary of Results

Sample ID	Concentration (mg/L)	Survival (# fish, N=30)	Percent Mortality	Dangerous Waste Designation
Control	0	30	0	NA
B-2-S	100	30	0	None
B-4-M	100	29	3.0	None
B-6-S	100	30	0	None
B-7-M	100	30	0	None
B-11-S	100	30	0	None
B-12-S	100	30	0	None
B-12-D	100	30	0	None
B-17-D	100	30	0	None

5.0 QUALITY ASSURANCE

The most recently completed reference toxicant test was initiated January 12, 2006. The LC₅₀ of 64.0 mg/L copper was acceptable based on control charting for this laboratory. The coefficient of variation (CV) for the last 20 tests was 41.4 percent, which is considered good by the Biomonitoring Science Advisory Board.

6.0 REFERENCES

Laboratory Guidance and Whole Effluent Toxicity Test Review Criteria. Washington State Department of Ecology Publication # WQ-R-95-80. Revised June 2005.

Biological Testing Methods 80-12 for the Designation of Dangerous Waste. Washington State Department of Ecology Publication #80-12. Revised April 1997.

Appendix A
Test Data

Dangerous Waste Toxicity Test
Toxicity Test Data Sheet - Washington Laboratory

Client: URS
 Sample ID: Maralco Restoration Project
 Test #: 0602-14WA

Start Date & Time: 2/7/06 1300
 End Date & Time: 2/11/06 1400
 Test Organism: Oncorhynchus mykiss
 Test Protocol: Washington State Department of Ecology Publ. 80-12

Conc.	Rep	Cont #	Number of Live Organisms					Dissolved Oxygen (mg/L)					pH (units)					Conductivity (umhos/cm)					Temperature (°C)					Percent Survival	
			0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96		
CON	1	9	10	10	10	10	10	9.4	8.9	9.5	9.1	9.0	7.47	7.38	7.21	7.37	7.40	69					71	12.2	10.5	12.4	11.7	11.8	
	2	2	10	10	10	10	10	9.8	9.4	9.9	9.2	9.0	7.76	7.56	7.45	7.55	7.45	98					95						
	3	25	10	10	10	10	10	9.8	9.5	9.8	9.2	9.1	7.68	7.55	7.40	7.60	7.51	66					67						100%
100ppm	1	24	10	10	10	10	10	9.1	9.4	9.9	9.3	9.2	7.47	7.38	7.36	7.50	7.48	81					80	12.4	11.7	11.5	11.7	11.5	
06-063	2	5	10	10	10	10	10	9.4	9.4	9.9	9.3	9.1	7.45	7.48	7.35	7.47	7.53	78					79						
B-2-S	3	19	10	10	10	10	10	9.7	9.3	9.9	9.3	9.0	7.71	7.56	7.45	7.47	7.45	102					104						100%
100ppm	1	1	10	10	10	10	10	9.6	9.6	9.7	9.5	9.2	7.77	7.63	7.45	7.62	7.50	100					103	12.1	12.0	11.7	11.5	11.6	
06-064	2	8	10	10	10	9*	9	9.3	9.6	9.7	9.3	9.3	7.59	7.48	7.55	7.66	7.58	72					72						
B-4-M	3	16	10	10	10	10	10	9.5	9.5	9.8	8.9	9.3	7.70	7.53	7.43	7.52	7.51	73					75						96.7%
100ppm	1	27	10	10	10	10	10	9.5	9.6	9.7	9.1	9.0	7.62	7.39	7.34	7.37	7.45	79					78	12.3	12.5	12.6	12.5	11.9	
06-065	2	6	10	10	10	10	10	9.2	9.6	9.6	9.1	9.1	7.55	7.45	7.43	7.42	7.46	101					103						
B-6-S	3	10	10	10	10	10	10	9.0	9.5	9.7	8.8	9.2	7.53	7.44	7.40	7.50	7.55	89					89						
100ppm	1	26	10	10	10	10	10	9.6	9.6	9.8	9.2	9.3	7.60	7.36	7.30	7.39	7.41	110					113	11.9	12.5	11.6	11.4	11.9	
06-066	2	14	10	10	10	10	10	9.7	9.5	9.9	9.4	9.2	7.67	7.48	7.43	7.42	7.45	138					140						
B-7-M	3	20	10	10	10	10	10	9.7	9.3	9.6	9.3	9.1	7.83	7.60	7.49	7.48	7.52	159					162						100%
100ppm	1	18	10	10	10	10	10	9.5	9.7	9.6	9.2	9.4	7.76	7.53	7.55	7.60	7.60	97					98	12.5	12.3	11.8	11.4	12.0	
06-067	2	4	10	10	10	10	10	9.8	9.8	9.7	9.1	9.3	7.78	7.56	7.55	7.62	7.58	103					102						
B-11-S	3	21	10	10	10	10	10	9.7	9.6	9.6	9.1	9.5	7.80	7.58	7.55	7.63	7.56	104					101						100%
100ppm	1	15	10	10	10	10	10	9.5	9.7	9.7	9.1	9.4	7.62	7.41	7.40	7.51	7.53	75					78	12.3	12.2	11.9	11.2	12.0	
06-068	2	23	10	10	10	10	10	9.1	9.6	9.6	9.0	9.2	7.50	7.45	7.40	7.53	7.55	78					79						
B-12-S	3	7	10	10	10	10	10	9.1	9.4	9.5	9.0	9.1	7.49	7.31	7.43	7.48	7.51	75					77						100%
Technician Initials			ML	LF	LF	HL	ML	HL	LF	LF	HL	ML																	

Sample	Alkalinity		Hardness	
	mg/L as CaCO ₃			
	Initial	Final	Initial	Final
control	32	20	36	28
06-063	40	32	32	36
06-064	32	36	52	44
06-065	32	36	44	40

Animal Source: Trout Lodge
 Date of Hatch: 12/25/05
 Test Volume: 8L
 Date Received: 1/24/06
 Date of Swim-up: 1/8/06

Weights (g): .126 .171 .171 .162 .148 .104 .144 .139 .162 .187 $\mu = .1502$
 Lengths (mm): 21 25 25 25 24 22 23 25 25 24 $\mu = 24$
 length max/min = 1.24
 Loading: 0.19 g/L

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 253-922-4296

Sample Description: _____
 * only 9 animals found

pg 205 C

**Dangerous Waste Toxicity Test
Toxicity Test Data Sheet - Washington Laboratory**

Client: JRS
 Sample ID: Maralco Restoration Project
 Test #: 0602-14 WA

Start Date & Time: 2/7/06 1300
 End Date & Time: 2/11/06 1400
 Test Organism: Oncorhynchus mykiss
 Test Protocol: Washington State Department of Ecology Publ. 80-12

Conc.	Rep	Cont #	Number of Live Organisms					Dissolved Oxygen (mg/L)					pH (units)					Conductivity (umhos/cm)					Temperature (°C)					Percent Survival	
			0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96		
100ppm	1	12	10	10	10	10	10	9.6	9.5	9.2	8.9	9.0	7.72	7.42	7.41	7.47	7.53	107					110	12.5	12.6	11.9	11.7	12.0	
06-069	2	17	10	10	10	10	10	9.5	9.2	9.4	9.0	9.0	7.83	7.62	7.55	7.50	7.51	124					119						
B-12-D	3	13	16	16	10	10	10	9.4	9.0	9.3	9.0	9.0	7.73	7.60	7.53	7.56	7.56	127					121						100%
100ppm	1	11	10	10	10	10	10	9.5	9.1	9.4	8.9	9.0	7.47	7.43	7.57	7.57	7.52	95					98	12.0	13.0	11.9	12.0	12.0	
06-068	2	22	10	10	10	10	10	9.3	9.1	9.3	8.8	8.9	7.78	7.59	7.56	7.51	7.55	131					129						
070	3	3	10	10	10	10	10	9.5	9.0	9.3	8.9	9.1	7.74	7.63	7.59	7.63	7.65	140					136						100%
B-17-D	1																												
	2																												
	3																												
	1																												
	2																												
	3																												
	1																												
	2																												
	3																												
	1																												
	2																												
	3																												
	1																												
	2																												
	3																												

Technician Initials: NLF L F LF HL mL AL LF LF HL ML

Sample	Alkalinity		Hardness	
	mg/L as CaCO ₃			
	Initial	Final	Initial	Final
06-066	48	52	44	48
06-067	44	48	60	52
06-068	40	40	60	52
06-069	44	40	60	52

Animal Source: Trout Lodge Test Volume: 8L
 Date of Hatch: 12/25/05 Date Received: 1/24/06
 Date of Swim-up: 1/8/06
 Weights (g): .126 .171 .171 .183 .148 .104 .104 .139 .162 .187 $\mu = .150$ g
 Lengths (mm): 21 25 25 25 24 22 23 25 25 26 $\mu = 24$ mm
 length max/min = 1.24 Loading: 0.19 g/L

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Sample Description: 06-070 46 42 32 36

Appendix B
Reference Toxicant Test
Control Chart and Statistical Summary

CETIS QC Chart

Acute Fish Survival Test

Nautilus Environmental WA

Test Type: Survival (96h)

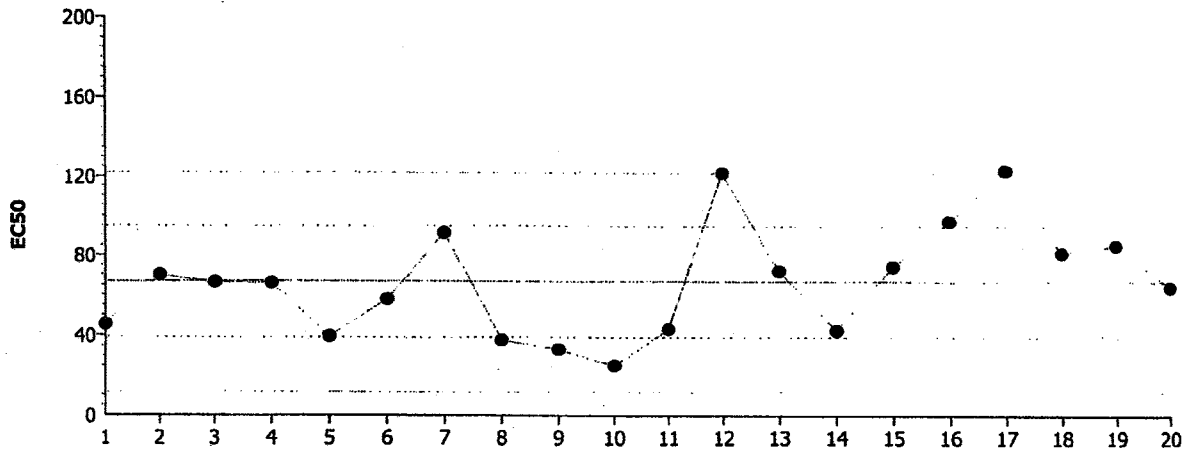
Organism: *Oncorhynchus mykiss* (Rainbow Tro)

Material: Copper sulfate

Protocol: EPA/821/R-02-012 (2002)

Endpoint: 96h Proportion Survived

Source: Reference Toxicant-REF



Mean: 66.7947 Count: 20 -1s Warning Limit: 39.1771 -2s Action Limit: 11.5595
 Sigma: 27.6176 CV: 41.35% +1s Warning Limit: 94.4124 +2s Action Limit: 122.03

Quality Control Data

Point	Year	Month	Day	Data	Delta	Sigma	Warning	Action	Link	Analysis
1	2004	Feb	2	45.55047	-21.2442	-0.76923			07-8511-4688	02-0671-5450
2		Mar	9	69.96443	3.16970	0.11477			12-7054-0474	05-3269-2002
3			29	66.31327	-0.48146	-0.01743			11-8112-0590	03-6175-9137
4		Apr	27	65.90278	-0.89195	-0.03230			17-5118-5392	05-3703-8798
5		Jun	2	39.61044	-27.1842	-0.98431			07-6739-1824	05-5759-3893
6			30	57.76980	-9.02493	-0.32678			07-8003-0382	14-5238-6228
7		Sep	21	91.17225	24.37752	0.88268			00-2966-9271	14-7822-0687
8		Oct	4	37.72911	-29.0656	-1.05243	(-)		04-8672-3486	17-4688-8148
9		Dec	13	32.98770	-33.8070	-1.22411	(-)		02-9314-6409	12-6114-4171
10	2005	Jan	26	25.00000	-41.7947	-1.51334	(-)		11-9321-8775	08-8067-2660
11		Feb	24	43.16335	-23.6313	-0.85566			02-2479-3148	07-2802-6469
12		Apr	6	121.7643	54.96957	1.99038	(+)		08-8736-2959	10-4962-4633
13		Jun	1	72.03579	5.24106	0.18977			17-5799-0743	02-2051-3081
14		Jul	6	42.53336	-24.2613	-0.87847			02-7208-7910	01-6268-3642
15		Aug	3	74.05488	7.26015	0.26288			01-7924-1014	15-0356-8542
16		Sep	7	96.95298	30.15825	1.09199	(+)		13-1906-2728	04-6772-8487
17		Oct	7	123.1144	56.31967	2.03926	(+)	(+)	06-0563-1613	13-7102-1635
18			28	81.22524	14.43051	0.52251			04-3069-6013	09-0070-2623
19		Dec	5	85.06672	18.27199	0.66161			03-8054-0292	11-3860-2079
20	2006	Jan	12	63.98339	-2.81134	-0.10180			11-6667-0064	07-2078-8121

CETIS Test Summary

 Report Date: 17 Jan-06 11:20 AM
 Link: 11-6667-0064/RT011206OM

Acute Fish Survival Test		Nautilus Environmental WA						
Test No:	14-6219-8033	Test Type:	Survival (96h)	Duration:	96h			
Start Date:	12 Jan-06 11:30 AM	Protocol:	EPA/821/R-02-012 (2002)	Species:	Oncorhynchus mykiss			
Ending Date:	16 Jan-06 11:15 AM	Dil Water:	Dechlorinated Tap Water	Source:	Trout Lodge Fish Farm			
Setup Date:	12 Jan-06 11:30 AM	Brine:						
Sample No:	06-5018-5992	Material:	Copper sulfate	Client:	Reference Toxicant Test			
Sample Date:	12 Jan-06 10:00 AM	Code:	650185992	Project:				
Receive Date:		Source:	Reference Toxicant					
Sample Age:	90m	Station:						
<i>not approved</i>								
Comparison Summary								
Analysis	Endpoint	NOEL	LOEL	ChV	MSDp	Method		
03-1653-0612	96h Proportion Survived	25	50	35.355	10.28%	Dunnett's Multiple Comparison		
Point Estimate Summary								
Analysis	Endpoint	% Effect	Conc-µg/L	95% LCL	95% UCL	Method		
07-2078-8121	96h Proportion Survived	50	63.98339	52.81684	77.51077	Trimmed Spearman-Kärber		
96h Proportion Survived Summary								
Conc-µg/L	Control Type	Reps	Mean	Minimum	Maximum	SE	SD	CV
0	Dilution Water	3	1.00000	1.00000	1.00000	0.00000	0.00000	0.00%
25		3	0.93333	0.90000	1.00000	0.03333	0.05774	6.19%
50		3	0.63333	0.50000	0.80000	0.08819	0.15275	24.12%
100		3	0.26667	0.20000	0.30000	0.03333	0.05774	21.65%
200		3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00%
400		3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00%
96h Proportion Survived Detail								
Conc-µg/L	Control Type	Rep 1	Rep 2	Rep 3				
0	Dilution Water	1.00000	1.00000	1.00000				
25		0.90000	1.00000	0.90000				
50		0.60000	0.80000	0.50000				
100		0.20000	0.30000	0.30000				
200		0.00000	0.00000	0.00000				
400		0.00000	0.00000	0.00000				

Appendix C
Chain-of-Custody Form



LEGEND

- ◆ Approximate Boring Location
- Decision Unit Lateral Boundary

